

**REMARKS**

Reconsideration and allowance of the present application based on the following remarks are respectfully requested.

Applicants are pleased to note the Examiner indicated that claims 4-12, 18 and 20 are allowable.

**Non-Compliance**

The Examiner states the requested corrections to pages 3, 5, 10, and 16 have not been addressed. The Examiner indicated in the Office Action dated November 21, 2002 that the amendments to be made on pages 3, 5, 10 and 16 have not been entered because the original wordings were not found. Accordingly, Applicant did not find that a statement was necessary to cancel the amendment made on pages 3, 5, 10 and 16 because the amendments were not entered. In any case, for the purpose of further clarification, Applicants hereby cancel the amendments made to the specification in the preliminary amendment filed January 12, 2001.

With regard to the objection made to the foreign priority document, the Examiner states the newly submitted front page of the previously submitted copy of European Patent Application 00300246.6 filed in Europe on 01/14/2000 is not a certified copy. In this regard, the Examiner is correct. The copy filed on March 18, 2003 is a copy of the certified copy filed on January 12, 2001 as shown on the date stamped receipt also filed on January 12, 2001. Applicants submit that no further certified copy is necessary as the required certified copy was filed with the original application in 2001.

In the Response to Amendment section, the Examiner maintains that the date of the Preliminary Amendment is April 16, 2001 because this date corresponds to the date the Preliminary Amendment has been "entered." Paper 4, the Office Action dated November 21, 2002, refers to "the preliminary amendment filed April 16, 2001" (emphasis added). Applicants merely respectfully pointed out that this alleged filing date was incorrect.

According to MPEP 505, "The United States Patent and Trademark Office stamps papers and fees with the date of their receipt in the Office. The stamp is referred to as the Office Date stamp." Since the OIPE stamp, i.e. "Office Stamp," shows the date of January

12, 2001, Applicants respectfully submit that the filing date of the Preliminary Amendment is January 12, 2001.

Claim Rejection – 35 USC § 102

Claims 1-3 and 13 are rejected under 35 U.S.C. § 102(b) as being allegedly anticipated by Nishi (US Pat. No. 5,003,342). Applicants respectfully traverse this rejection for at least the following reasons.

With respect to claim 1, the Office Action contends that Nishi discloses a lithographic projection apparatus comprising all the elements recited in claim 1 and specifically a calibration system around element 12 shown in Fig. 1 or element 13 shown in Fig. 3, which is an interferometer system to measure lateral displacement of a reference point in a plane of the object table 9 as a function of tilt, at the measurement position, as recited in col. 4, lines 61-68 and col. 8, lines 10-30, wherein the calibration system around element 12 in Fig. 1 or element 13 in Fig. 3 comprises: a diffraction grating 15 mounted to the second object table 9 as shown in Fig. 1 and Fig. 3 and recited in col. 5, lines 40-50; an illuminator to the left of light guide 21 which generates a measurement beam of radiation and directs the beam through a reflector 22-23 to be incident on diffraction grating 15 and a detector which detects the position of diffraction grating 15.

In response to the arguments filed March 5, 2003 (the Office Action indicates a different date: March 18, 2003) the Office Action states that Applicants' argument that Nishi is merely concerned about displacement errors due to rotation about the Z axis and not tilting of the XY is a grave misunderstanding of the prior art. Applicants respectfully disagree.

Applicants reiterate the arguments filed on March 5, 2003. Moreover, in col. 8, lines 14-20, Nishi states that "the count value of each of the counters is reset to zero with wafer stage 9 being inclined by an amount of, for example,  $\Delta\theta_1$  with respect to the X axis of the X-Y coordinates, a measurement error corresponding to the inclination of  $\Delta\theta_1$  occurs between the measurement results of the laser interferometers 13 and 14." Applicants submit that according to Figure 2 of Nishi, interferometer 13 and interferometer 14 are disposed such that they detect displacements of stage 9 along the Y direction (see col. 5, lines 5-18).

Consequently, in order to detect a measurement error between interferometer 13 and interferometer 14 as stated above, the stage 9 must be rotated "inclined" around the axis Z which is perpendicular to XY plane. The statement in Nishi that the stage 9 is inclined with respect to X direction, refers to the X-Y coordinate system of the stage 9 being inclined, i.e.

rotated, with respect to the X axis in the plane XY when rotated around axis Z by an angle  $\Delta\theta_1$ . This is further substantiated by the fact that in col. 8, lines 38-43, Nishi states that the main controller 20 is arranged to detect the Y-direction measurement error occurring between the Y-direction measured values detected by the laser interferometers 13 and 14 due to yawing, i.e. rotation of the stage 9 about vertical axis Z, in the zero-resetting of the counters, manufacturing errors or the like.

Accordingly, contrary to the Office Action statement that Applicants' argument filed on March 5, 2003 is a misunderstanding of the Nishi reference, Applicants have fully understood the Nishi reference and maintain that Nishi does not disclose, teach or suggest providing a calibration system to measure lateral displacement as a function of tilt.

Furthermore, Nishi et al. merely provides measurements of Abbe errors due to rotation around the Z axis of the substrate table in the XY plane and does not provide measurements and/or calibration of Abbe arm related to tilt. Applicants submit that setting Abbe arm related to tilt to zero is more complicated than setting Abbe arm related to rotation around the vertical axis, i.e. Z-axis because the setting of Abbe arm related to tilt also depends on focus errors.

Consequently, for at least the above reasons, Nishi does not disclose, teach or suggest the subject matter recited in claim 1.

Therefore, Applicants respectfully submit that claim 1 is patentable and respectfully request that the rejection under § 102(b) of claim 1 be withdrawn.

Claim 2 is dependent from claim 1. Therefore, for at least the above reasons, Applicants respectfully submit that claim 2 is patentable and respectfully request that the rejection under § 102(b) of claim 2 be withdrawn.

Moreover, Nishi does not disclose, teach or suggest the additional limitations of claim 2. Specifically, Nishi does not disclose, teach or suggest a light beam which directs the measurement beam to be incident on the diffraction grating in a direction substantially independent of the tilt of the object table. In col. 6, lines 23-35, Nishi is merely concerned about detecting the X, Y direction positions of a chip by irradiating an alignment mark on the wafer W by detecting light diffracted from beam spot SPx or SPy.

Claim 3 is dependent from claim 1. Therefore, for at least the above reasons, Applicants respectfully submit that claim 3 is patentable and respectfully request that the rejection under § 102(b) of claim 3 be withdrawn.

Claim 13 is dependent from claim 1. Therefore, for at least the above reasons, Applicants respectfully submit that claim 13 is patentable and respectfully request that the rejection under § 102(b) of claim 13 be withdrawn.

Moreover, Nishi does not disclose, teach or suggest the additional limitations of claim 13. Specifically, Nishi does not disclose, teach or suggest a plurality of calibration systems for measuring displacement of the second object table with tilt about a plurality of axes. As stated above, Nishi is merely concerned about detecting yawing of the wafer 9, i.e. rotation of the wafer about vertical axis Z, not tilt of the XY plane.

Claims 14-16 are rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Nishi as applied to claim 1 and further in view of Ota (US Pat. No. 5,831,739), Murata (JP-09199573 A) and Yamamoto *et al.* (US Pat. No. 5, 053,628). Applicants respectfully traverse this rejection for at least the following reasons.

With regard to claim 14, the Office Action contends that Nishi describes a method of calibrating a lithographic projection apparatus including measuring a position of a reference point on a surface of an object table 9 for holding a substrate W having a surface to be exposed wherein the limitation of different tilts is a further generalization or expansion within skill in the art of Nishi's recitation in col. 8, lines 10-14. The Office Action further contends that Nishi's method includes calculating a distance between the surface of the object table 9 and a rotation-invariant point of the object table, which is well known in the art as the "Abbe arm," as implicated in col. 9, lines 20-52; and adjusting parameters of an electronic controller 20 included in the positioning system for moving the object table 9 between an exposure (on-axis) position shown in Fig. 3, as disclosed in col. 6, lines 23-35 and 59-68, col. 7, lines 1-10, and further in col. 8, lines 9-68 and col. 9, lines 1-20, so that the rotation invariant point is at a predetermined vertical distance from the reference point of the object table as implicated in col. 9, lines 44-59.

The Office Action also contends that the limitations covered by Nishi's method are separately, specifically and additionally rendered obvious by Murata and further by Ota, as shown in Fig. 3, 4 and 5 regarding the step of measuring different tilts by means of difraction grating and the measurement of X and Y positions by the laser interferometers and thus it would have been obvious to one of ordinary skill in the art to eliminate from Nishi's invention those elements that are not needed while retaining only the essential steps to practice Applicant's invention as recited in Murata, Ota and Yamamoto *et al.*

In response to the arguments filed on March 5, 2003, the Office Action contends that Applicants' argument is partly the same as the previously refuted argument regarding claim 1 and Applicants' argument that neither Murata nor Ota nor Yamamoto measures of a reference point is not persuasive. Moreover, the Office Action states that Applicants' argument that Murata is silent about detecting displacements of a reference point of the second object table at various angle tilt when situated at a measurement position "is quite ridiculous," and that Applicants' argument is nothing else than a conventional definition of Abbe's error detection which recited in the solution section in Murata. Applicants respectfully disagree.

Applicants reiterate the arguments filed March 5, 2003. Specifically, Nishi merely provides a measurement system in which the position of the wafer stage 9 in the X and Y directions is measured, as stated previously. For at least the reasons provided above in claim 1, Applicants submit that Nishi is merely concerned about displacement errors due to rotation about the Z axis and not tilting of the XY plane. Therefore, Nishi is completely silent about measuring a position of a reference point on a surface of an object table for holding a substrate having a surface to be exposed at different tilts.

With regard to Murata, the Office Action statement is taken out of context. Applicants argued that the Murata reference is completely silent about measuring a position of a reference point on a surface of an object table at different tilts (emphasis added). Moreover, as stated in the response filed March 5, 2003, Murata does not disclose or suggest calculating a distance between the surface of the object table and a rotation-invariant point of the object table. Per MPEP 2143.03, to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

With regard to Ota, this reference merely teaches an alignment method in which a plurality of alignment marks are used in X and Y coordinates. As described in col. 8 lines 14-20 and shown in Figure 5 of Ota, the wafer mark MXi for the X-axis is a grating-shaped pattern comprising small square patterns which are arrayed at a predetermined pitch in the direction Y and the wafer mark MYi for the Y-axis is a grating-shaped pattern comprising small square patterns which are arrayed at a predetermined pitch in the direction X. However, Ota does not disclose or suggest measuring a position of a reference point on a

surface of an object table at different tilts. Ota is related to solving a different problem than the invention recited in claim 14.

With regard to Yamamoto *et al.*, this reference merely teaches an apparatus for wafer position alignment using interference fringes reflected by a diffraction grating on the wafer. The interference fringes are reflected back through the projection lens system and detected by a phase meter. Yamamoto *et al.* however, does not disclose or suggest anything relating to measuring a position of a reference point on a surface of an object table at different tilts.

Moreover, even if combining the above relied upon references, one of skill in the art would not arrive at the method of calibrating a lithographic apparatus recited in claim 14.

Therefore, none of the relied upon references, i.e. Nishi, Murata, Ota and Yamamoto *et al.*, alone or in combination, discloses, teaches or suggests the subject matter recited in claim 14.

With regard to claim 15, the Office Action contends that Nishi describes a method of manufacturing a device using a lithographic projection apparatus including detecting displacements of a reference point of the second object table at various angles of tilt when situated at the measurement position as is inherent in Nishi and further rendered obvious by Murata, Ota and Yamamoto *et al.* as applied to claim 14. Applicants respectfully disagree.

As stated above, Nishi is merely concerned about displacement errors due to rotation about the Z axis and not tilting of the XY plane.

As stated above, Murata is silent about detecting displacements of a reference point of the second object table at various angles of tilt when situated at a measurement position.

As stated above, Ota merely teaches an alignment method in which a plurality of alignment marks are used in X and Y coordinates. Ota is, however, completely silent about tilting of the object table much less detecting displacements of a reference point of the second object table at various angles of tilt. Similarly, Yamamoto *et al.* merely describes an apparatus for wafer position alignment using interference fringes reflected by a diffraction grating on the wafer. The interference fringes of Yamamoto *et al.* are reflected back through the projection lens system and detected by a phase meter. Yamamoto *et al.*, however, is completely silent about detecting displacements of a reference point of the second object table at various angles of tilt.

Moreover, even if combining the above relied upon references, one of skill in the art would not arrive at the method of manufacturing a device using a lithographic projection apparatus as recited in claim 15.

Consequently, none of the relied upon references, i.e. Nishi, Murata, Ota and Yamamoto *et al.*, alone or in combination, discloses, teaches or suggests the subject matter recited in claim 15.

The above discussion of Murata, Ota, and Yamamoto should not be regarded as arguing against the references individually, but rather as pointing out that those references fail to overcome the deficiencies of Nishi '342, already set forth.

Therefore, for at least the above reasons, Applicants respectfully submit that claims 14 and 15, and claim 16 which is directly dependent from claim 15 are patentable and respectfully request that the rejection under § 103(a) of claims 14-16 be withdrawn.

Claims 17 and 19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishi in view of Ota, Murata and Yamamoto. Claims 17 and 19 depend from respectively claim 14 and claim 15. Applicants submit that claims 17 and 19 are patentable for at least the reasons presented above for claim 14 and claim 15.

**CONCLUSION**

In view of the foregoing, the claims are now believed to be in form for allowance, and such action is hereby solicited. If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, please contact the undersigned at the telephone number listed below.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Respectfully submitted,

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